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$\frac{m}{n}=\frac{1}{7}$, $y=\frac{14}{N-49}$,

$N=$	35	(43)	(44)	(45)	(46)	47	48	□	50	51	(52)	(53)	(54)	(55)	56
$y=$	1					7	14		14	7					2
$x=$	6					48	97		99	50					15

$\frac{m}{n}=\frac{1}{8}$, $y=\frac{16}{N-64}$,

$N=$	48	57	58	59	60	61	62	63	□	65	66	67	68	69	70	71	72
$y=$	1				4		8	16		16	8		4				2
$x=$	7				31		63	27	129		65						17

$\frac{m}{n}=\frac{1}{9}$, $y=\frac{18}{N-81}$,

$N=$	63	73	74	75	76	77	78	79	80	□	82	83	84	85	86	87	88	89	90
$y=$	1			3			6	9	18		18	9	6			3			2
$x=$	8																		19

$\frac{m}{n}=\frac{1}{10}$, $y=\frac{20}{N-100}$,

$N=$	80	91	92	93	94	95	96	97	98	99	□	101	102	103	104	105	106	107	108	110
$y=$	1				4	5			10	20	20		10		5	4				2
$x=$																				

It is seen that the position of the numbers N, between the two consecutive square numbers, determines the ease of obtaining the values of x and y. As,let a^2 and a_2^2, represent the two squares, then in $a^2+a, y=2$, in numbers N, of the form of $a^2+2a, y=1$. The more complex numbers are always found midway between a^2+a and a^2+2a.

There are two values of x and y, N being of the form of a^2-1. It is, however, the second higher value of x and y, as x_2 and y_2.

Other series can easily be found giving, the values also in a regular series.

A. H. BELL, Hillsboro, Illinois.

(TO BE CONTINUED.)

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

Solution to a Problem by Professor G. B. M. ZERR, A. M., Principal of Schools, Staunton, Virginia.

Three persons $A.$, $B.$, $C.$, throw with three dice. They each stake $10, and the one who first throws exactly 10 with the three dice, takes the whole stake. Find the expectation of each.

There is probably no subject that is more interesting than the subject of Average and Probability, and that part of this subject that deals

with games of chance is especially fascinating. In the above problem in order to throw ten, one die must turn up 6, one 3, and one 1; or one must turn up 6, one 2,and one 2;or one must turn up 5,one 3,and one 2;or one must turn up 5,one 4,and one 1;or one must turn up 4, one 4,and one 2; or one must turn up 4,one 3, and one 3. The first can happen six ways as follow: 6, 3, 1; 6, 1, 3; 3, 1, 4; 3, 1, 6; 1, 3, 6; 1,6, 3;.. in all 6 ways,
the second 6, 2, 2; 2, 6, 2; 2, 2, 6;........................in all 3 ways,
the third 5, 3, 2; 5, 2, 3; 2, 5, 3; 2, 3, 5; 3, 2, 5; 3, 5, 2;....in all 6 ways,
the fourth 5, 4, 1; 5, 1, 4; 4, 1, 5; 4, 5, 1; 1, 5, 4; 1, 4. 5;.....in all 6 ways,
the fifth 4, 4, 2; 4, 2, 4; 2, 4, 4;...........................in all 3 ways,
the sixth 4, 3, 3; 3, 4, 3; 3, 3, 4;..........................in all 3 ways,

GIVING 27 WAYS.

The chance that one die will turn up 6 is $\frac{1}{6}$.
The chance that another die will turn up 3 is $\frac{1}{6}$.
The chance that third die will turn up 1 is $\frac{1}{6}$.

Hence, the chance that 6, 3, 1 in order given will turn up on one throw is $\frac{1}{6}\times\frac{1}{6}\times\frac{1}{6}=(\frac{1}{6})^3$ and since ten can turn up in 27 ways, the chance of throwing ten on the first throw is $27\times(\frac{1}{6})^3=(\frac{3}{6})^3=(\frac{1}{2})^3=\frac{1}{8}$.

$\therefore$ The chance that A will throw ten is $\frac{1}{8}$ and the chance that he will not throw ten is $\frac{7}{8}$. The chance then that B will throw ten is the product of the chances of A's failing and of throwing ten on one throw$=\frac{1}{8}\times\frac{7}{8}$; the chance of A and B both failing is $1-(\frac{1}{8}\times\frac{7}{8}+\frac{1}{8})=\frac{49}{64}=(\frac{7}{8})^2$: unity minus the chance that A throws ten plus the chance, if A fails, that B throws ten .

Hence, the chance that C throws ten is $\frac{1}{8}\times(\frac{7}{8})^2$ and the chance that he fails is $1-\left\{\frac{1}{8}+\frac{1}{8}(\frac{7}{8})+\frac{1}{8}(\frac{7}{8})^2\right\}=(\frac{7}{8})^3$.

	A's chance	*B*'s chance	*C*'s chance
A's first throw......	$\frac{1}{8}$	$\frac{1}{8}(\frac{7}{8})$	$\frac{1}{8}(\frac{7}{8})^2$
A's second throw....	$\frac{1}{8}(\frac{7}{8})^3$	$\frac{1}{8}(\frac{7}{8})^4$	$\frac{1}{8}(\frac{7}{8})^5$
A's third throw.....	$\frac{1}{8}(\frac{7}{8})^6$	$\frac{1}{8}(\frac{7}{8})^7$	$\frac{1}{8}(\frac{7}{8})^8$
&c. &c. &c.	&c.	&c.	&c.

A's chance is the sum of the geometrical progression

$$\frac{1}{8}\left\{1+\left[\frac{7}{8}\right]^3+\left[\frac{7}{8}\right]^6+\left[\frac{7}{8}\right]^9+\ldots\ldots+\text{ to infinity}\right\}=\frac{1}{8}\times\frac{(8)^3}{169}=\left[\frac{8}{13}\right]^2.$$

B's chance is the sum of the geometrical progression

$$\frac{1}{8}\left\{\frac{7}{8}+\left[\frac{7}{8}\right]^4+\left[\frac{7}{8}\right]^7+\left[\frac{7}{8}\right]^{10}+\ldots\ldots+\text{ to infinity}\right\}=\frac{7\times 8}{(13)^2}=\frac{56}{(13)^2}.$$

C's chance is the sum of the geometrical progression

$$\frac{1}{8}\left\{\left[\frac{7}{8}\right]^2+\left[\frac{7}{8}\right]^5+\left[\frac{7}{8}\right]^8+\left[\frac{7}{8}\right]^{11}+\ldots\ldots+\text{ to infinity}\right\}=\left[\frac{7}{13}\right]^2.$$

The expectation in a game of chance is the product of the chance of winning into the stake offered minus the stake put up by the winning person.

A's expectation is $\left[\frac{8}{13}\right]^2$ of \$30—\$10=\$11$\frac{61}{169}$ —\$10=\$1$\frac{61}{169}$.

B's expectation is $\left[\frac{56}{(13)^2}\right]$ of \$30—\$10=\$9$\frac{159}{169}$—\$10=—\$$\frac{10}{169}$.

C's expectation is $\left[\frac{7}{13}\right]^2$ of \$30—\$10=\$8$\frac{118}{169}$—\$10=—\$1$\frac{51}{169}$.

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MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

PROBLEMS.

5. **Proposed by Professor G. B. M. ZERR, A. M., Principal of Schools. Staunton, Virginia.**

A cubic mile of saturated air at 18°C. is cooled to a temperature of 10°C. How many tons of rain will fall?

6. **Proposed by H. C WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.**

Two men wish to buy a grindstone 42 inches in diameter and one foot thick at the center. To what thickness at the outer edge should the stone uniformily taper from the center that each man may grind off 18 inches of the diameter and both have equal shares, the central six inches of the diameter being waste?

7. **Proposed by Rev. A. L. GRIDLEY, Pastor of Congregational Church, Kidder, Missouri.**

Making no allowance for the curvature of the earth and supposing he sun to rise in the east and set in the west, what would be the course of a man who should walk constantly toward the sun from morning until night? How far and in what direction from the starting point would he be, walking three miles per hour, at the end of three days?

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QUERIES AND INFORMATION.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

Note to Professor Dickson's Article on Triangles, by Josiah H. Drummond, Portland, Maine.

The late Judge, Josiah Scott, of the Supreme Court of Ohio, published in 1871 a pamphlet (in which he modestly said, in substance, that while the Mathematician might find nothing new in it,yet the Student might not find it wholly without interest) demonstrated that $2mn$, m^2-n^2, and m^2+n^2 give the "lowest intergers representing sides of a right angled triangle" when m and n are any numbers, one odd and one even, and *prime to each other* and $m>n$.

This rule has seemed to me the most practical of any that I have seen.